DRAFT ASSESSMENT SCHEDULE – For planning purposes only

Physics 2.4: Demonstrate understanding of mechanics

Assessment Criteria

Achievement	Achievement with Merit	Achievement with Excellence
Demonstrate understanding of mechanics by: • writing statements that show an awareness of how simple facets of phenomena, concepts or principles relate to a described situation • solving straightforward mathematical problems.	*Demonstrate in-depth understanding* of mechanics by: • writing statements that show understanding of how phenomena, concepts or principles relate to given situations • using information that is not immediately obvious or directly usable for mathematical statements.	*Demonstrate comprehensive understanding* of mechanics by: • writing statements that show understanding of why phenomena, concepts or principles relate to given situations • written descriptions will demonstrate understanding of connection between concepts including graphs and diagrams • using mathematical solutions that demonstrate understanding of connection between concepts.

Evidence Statement

One	Not achieved		Achievement		Achievement with Merit		Achievement with Excellence	
	N0 N1	No evidence ONE correct	A3	TWO correct	M5	TWO correct	E7	ONE correct
	N2	TWO correct	A4	THREE correct	M6	THREE correct	E8	TWO correct
(a)	$v = \frac{d}{t}$ $v_i = 0$		Calculates the velocity accurately: $v_f = v_i + at$ $v_f = 0 + 2.5 \times 9.8$ $v_f = 24.5 \text{ m s}^{-1}$					
(b)	Air. Resistance and mass.		States EACH of the following forces: • air resistance • force of gravity.		Explains air resistance acts upwards AND gravity force acts downwards.			
(c)	The stone decelerates. The stone reaches terminal velocity.		States that the stone decelerates as it enters the water because the forces are unbalanced. Describes the stone reaches terminal velocity because the forces are balanced.		Explains that the stone decelerates as it enters the water because the forces are unbalanced. This is because the upward force is greater than the downward force. Explains the stone reaches terminal velocity because the forces are balanced.		Explains in detail the stone initially decelerates downwards because the gravity force is less than the upthrust and frictional force of the water. Explains in detail that as it moves down it slows, the forces acting downwards equal the forces acting upwards acting on the stone (frictional force = gravity force). So these forces are balanced and hence the stone no longer accelerates and reaches constant velocity or terminal velocity.	
(d)	Uses 25 ms^{-1} as initial horizontal or vertical velocity OR calculates horizontal and vertical components using incorrect trig ratios.		Calculates: $\text{V(hor)} = 25\cos34 = 20.7 \text{ m s}^{-1}$ $\text{V(vert)} = 25\sin34 = 14.0 \text{ m s}^{-1}$		Calculates: $v_f = v_i + a$ $0 = 14 - 9.8t$ $t = 1.43 \text{ s}$ $\text{Total time} = 1.43 \times 2 = 2.86 \text{ s}$		Calculates: $d = vt$ $\text{d} = 20.7 \times 2.86$ $\text{d} = 59 \text{ m}$	

Two	Not achieved		Achievement		Achievement with Merit		Achievement with Excellence	
	N0 N1	No evidence ONE correct	A3	TWO correct	M5	TWO correct	E7	ONE correct
	N2	TWO correct	A4	THREE correct	M6	THREE correct	E8	TWO correct
(a)	$v = \frac{d}{t}$ $v = \frac{2\pi r}{T}$		Calculates: $v = \frac{2\pi r}{T} = \frac{2\pi \times 28.0}{12.0}$ v = 14.7 m s^{-1}		Calculates: $a = \frac{v^2}{r}$ $a = \frac{14.7^2}{28.0}$ a = 7.72 m s^{-2}			
(b)	The car would slip. The car moves away from the circular path.		Describes the car goes in a straight line OR describes the car moves at tangent to the circle.		Explains there is no longer any centripetal force. Explains the car moves in a straight line at constant speed at a tangent to the circle.		Explains in detail in the absence of friction, there is no unbalanced force. Explains in detail, hence, the car no longer accelerates. Explains in detail it will move in a straight line at constant speed at a tangent to the circle.	
(c)	Arrow showing weight force of car and bridge drawn vertically down.		One set of torques calculated correctly.		Provides the correct calculation to either F_A OR F_B.		Correctly calculates: $(10 \times 1500 \times 9.8) + (15 \times 5000 \times 9.8)$ $F_B = \frac{147000 + 735000}{30}$ F_B = 29400 N F_A = 14700 + 49000 – 29400 F_A = 34300 N	

	Not achieved		**Achievement**		**Achievement with Merit**		**Achievement with Excellence**	
Three	**N0** **N1**	**No evidence** **ONE correct**	**A3**	**TWO correct**	**M5**	**TWO correct**	**E7**	**ONE correct**
	N2	**TWO correct**	**A4**	**THREE correct**	**M6**	**THREE correct**	**E8**	**TWO correct**
(a)	$p = mv$		States or implies that momentum is conserved: $\sum p_i = \sum p_f$		Correctly calculates: $m_1 v_1 = (m_1 + m_2)v$ $v = \frac{1500 \times 18}{1500 + 650}$ $v = 12.6 \text{ m s}^{-1}$			
(b)	$p = mv$		Describes less force since time is longer.		Explains the momentum of the car before collision is greater than the momentum of the car after collision. A crumple zone will ensure there is less damage due to collision since force is less.		Explains in detail the change in momentum is the same. Since change in momentum is the same, the crumple zone provides a greater time for the force to act. Hence the force is less. Since $\Delta p = F\Delta t$.	
(c)	Work done = Fd		Correctly uses work done = Fd but substitutes incorrectly: $W = 850 \times 45$ $P = 850 \times \frac{45}{15}$ $P = 2550$ Calculates work using radian mode.		Calculates the work done correctly: $W = Fd\cos 42$ $W = 28425$ J		Correctly calculates the power of the tow truck. Work done = $\text{F}\cos 42 \times 45$ $\text{W} = 850\cos 42 \times 45$ $\text{W} = 28425$ J $P = \frac{28425}{15}$ $P = 1895\ W$ $P = 1900\ W$	
(d)	Spring constant indicates the stiffness of a spring.		Describes energy stored in a spring increases as the spring constant increases energy stored in a spring $E_p = \frac{1}{2}kx^2$		Explains the energy stored in a spring increases as the spring constant increases, when the extension or compression remains the same.		Explains in detail the energy stored in a spring $E_p = \frac{1}{2}kx^2$ The energy stored is directly proportional to the spring constant for a given extension. As spring constant	

				increases, the energy stored increases. So, for a smaller compression, the stiffer spring can absorb the same amount of energy.

Judgement Statement

Achievement	Achievement with Merit	Achievement with Excellence
Minimum of 2A	Minimum of 2M	Minimum of 2E